

Augustana University SiPM Test Stand

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Introduction

- ▶ Augie's contribution to sPHENIX.
 - ▶ Collaboration has 100k+ SiPMs to test, categorize, etc.
 - ▶ Augie has several resourceful undergraduates.
 - ▶ We can't test them all. But we can certainly help.
- ▶ Augie's good fortune: 2/3 of faculty (DA and NG) working with SiPMs
 - ▶ DarkSide, 3rd generation dark matter search detector also using SiPMs.
 - ▶ Can share costs, equipment, students, etc.
- ▶ Vivian spent over 1 month at UIUC making 2-d projective modules and learning their SiPM test stand setup. Also visited with UMich briefly to coordinate activities.
- ▶ Vivian and Trevor have spent the last several weeks putting together the test stand.

The Test Stand



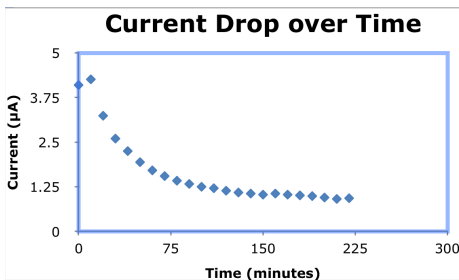
- ▶ Image of our setup
 - ▶ Dark box with SiPM, Rev C board (thanks Steve!), LED
 - ▶ Keithley PS and PS for preamp.
 - ▶ Recently moved to a dual channel PS
 - ▶ Pretty rough setup with alligator clips connecting PS to pream power cord.
 - ▶ Output transformer (thanks Steve!) to BNC and mostly focused on high gain out through scope.
 - ▶ Recently have DRS4 digitizer through RCDAQ

Current Draw without LED

- ▶ Measure current draw on SiPM with power to preamp and bias voltage and NO LED.
- ▶ Drops with a long time scale.
- ▶ 50% over three days.

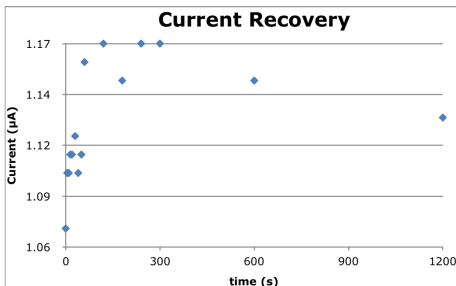
time	current μA
4:35 PM	0.86
10:23 AM	0.51
5:31 PM	0.53
1:36 PM	0.46
1:00 PM	0.49

Current Draw without LED



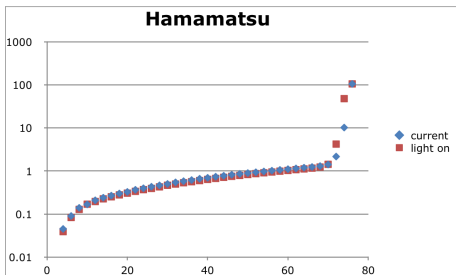
- ▶ Current very high when powering on SiPM initially.
- ▶ Drops slowly and takes days to settle.
- ▶ Clearly some extra capacitance around but we've been unable to identify it.

Current Draw without LED



- ▶ Measure the current after bias being off for a given amount of time.
- ▶ Recovery looks different than drop.
- ▶ Poor scientist's solution: just leave it on continually.

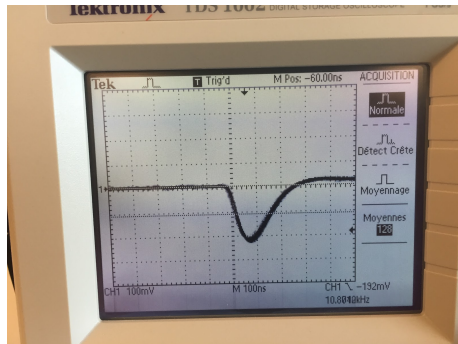
I-V of Hamamatsu 15 μm SiPM



- ▶ After being on for a while so current settles, measure I-V curve without LED.
- ▶ Doesn't look unreasonable. But didn't double check the suggested operating voltage.

LED Signal

- ▶ With LED, signal doesn't look unreasonable.
- ▶ Signal before our preamp power cable broke – should get a new one soon (Thanks Steve!)



Summary and Next Steps

- ▶ We have a test stand with dark box, bias PS, preamp, and digitizer for SiPM characterization.
- ▶ Lots of work left.
 - ▶ Isolate stray capacitance.
 - ▶ Tracking down a $7\ \mu\text{s}$ RF signal (maybe from our LED pulser)
 - ▶ Bought a bud box for stability and organizing cables.
 - ▶ Getting new power preamp cables from Steve.
 - ▶ Old machine for DAQ might not be playing nice with DRS4 digitizer.
- ▶ But, we have a full chain of seeing LED signals in our SiPMs and digitized and read through RCDAQ.